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Vowel Project: Analysis of a Native-Arabic Speaker

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VOWEL PROJECT: ANALYSIS OF A NATIVE-ARABIC SPEAKER

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ABSTRACT

This paper investigates the pronunciation of a non-native speaker of English. The subject was a native-speaker of Arabic. Eleven vowels produced by the subject were recorded and analyzed using the phonetic software, Praat, and were subsequently compared to pronunciation of general American English speakers. Differences in pronunciation are discussed and an intelligibility assessment is provided. In addition, the pedagogical implications of these pronunciation differences are discussed.

1.0 Biography of Subject

Our subject is an early 20's male from Saudi Arabia who is attending English classes at the Intensive English Center (IEC) at St. Cloud State University. He has been attending the IEC for nine months and has progressively moved through the program improving his English skills. He started the program at the beginning: pre-level 1. He recently finished level 3 successfully and is moving on to level 4. In this level, he will continue to hone his written, spoken, listening and reading skills. Level 4 is dedicated to further developing students' academic skills including coaching on oral presentations, academic speech, and essay format, note-taking skills, advancing literary skills and increasing academic vocabulary.

Our subject admitted that he is most proficient with speaking and reading skills. He mentioned he prefers writing prompts that focus on comparing and contrasting. His writing and listening skills are what take up more of his study time as they are skills that are very difficult for him. As he is very serious about becoming fluent, his current focus is improving his English skills in order to attend the University and major in electrical engineering.

When talking with his friends, our subject mostly speaks in a casual manner; using a lot of slang and swear words. He and his friends practice language courtesy by using English over their native language, Arabic, when other international friends are present. His international friends include French and Spanish speakers. Therefore, he resorts to speaking English, the common language amongst them, when in their presence. According to Krashen's I+1 theory, our subject is actively working towards improving his English skills by surrounding himself with friends whose English skills are more advanced than his own (Gass & Selinker, 2006). Although he is unfamiliar with Krashen's theory, he feels his English has improved immensely due to the advanced English skills his friends within his social network.

Our subject states that he also takes advantage of every opportunity to speak with his American friends, whom he has come to know well through other friends. He frequently tries to use new phrases and words that he has learned in class. To better his English, he also tries to find new meanings and definitions for unfamiliar words. He often recognizes that he is unfamiliar with many words and will ask his friends or use his cell phone as a translator to explore meaning and use. Other methods of studying our subject utilizes include watching English movies at home and finding different places to eat lunch that will maximize his chances of English interaction. Additionally, he plans to move to the dorms in hopes of surrounding himself with more Americans and native English speakers.

The type of technology that our subject prefers to use is his cell phone. He has two cell phones; one is in Arabic, the other is in English. Since moving to Minnesota, the English cell phone is the only phone he has used. His cell phone is his main study source. He uses it as his electronic dictionary as well as his translator for both written and spoken words. Another source of technology that our subject uses almost as often as his cell phone is his computer. Often times in between classes, he will go on the internet and listen to and watch YouTube videos in English. These videos include music videos, stunts, movie clips and trailers. Additionally, for his vocabulary class, he has access to quizlet.com. This website is used by instructors to create tests and other activities for their students to use. It is specifically used for second language learners.

Overall, our subject feels that he is progressing rapidly due to the fact that his friends speak better English than he does. He has also met and become good friends with some Americans who can explain many phrases, colloquialisms, idioms and the semantic structure of casual conversation. He realizes that his social network helps him improve communicatively in casual conversation, but that in order to improve his academic English, he must continue taking English classes in the IEC. These classes provide him with the academic language practice and development he will need in order to pass the TOEFL exam and move on to the university.

2.0 Acoustic Analysis

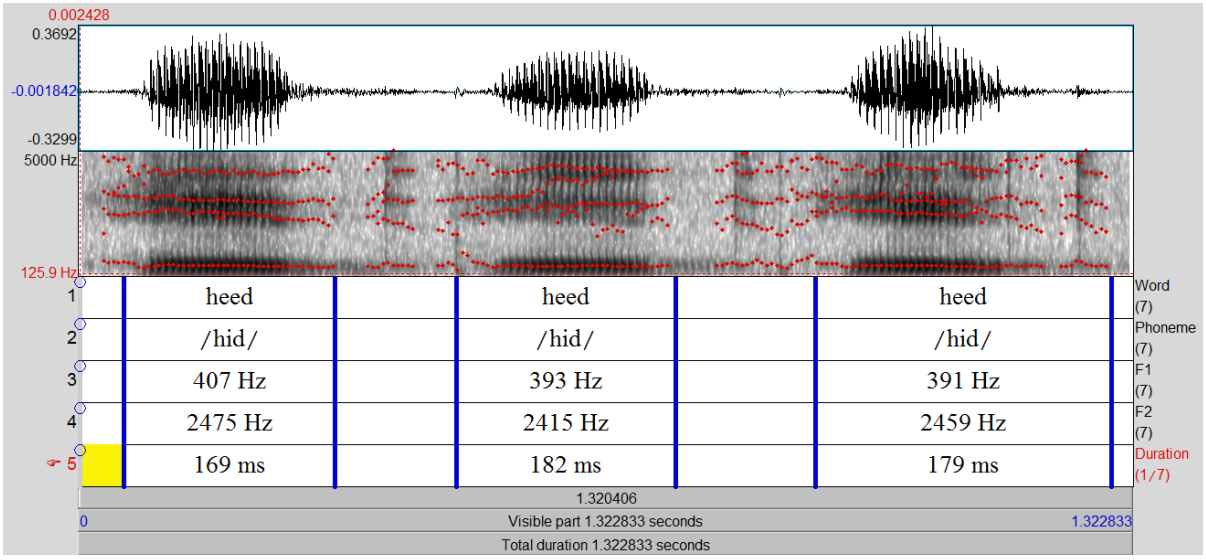

Figure 1: Heed [i]

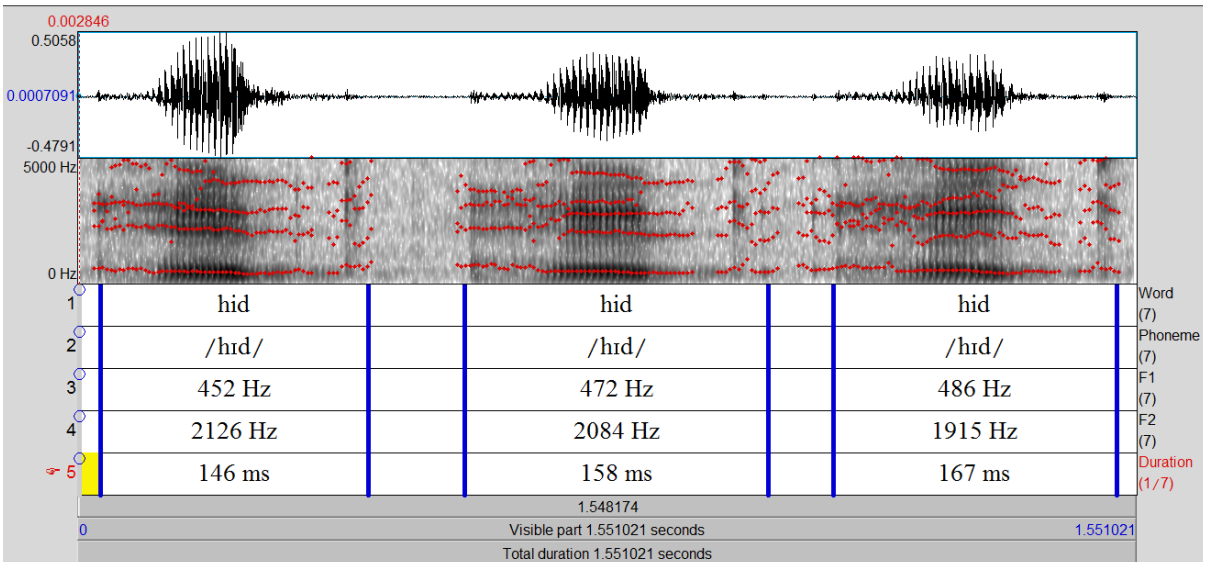

Figure 2: Hid [ɪ]

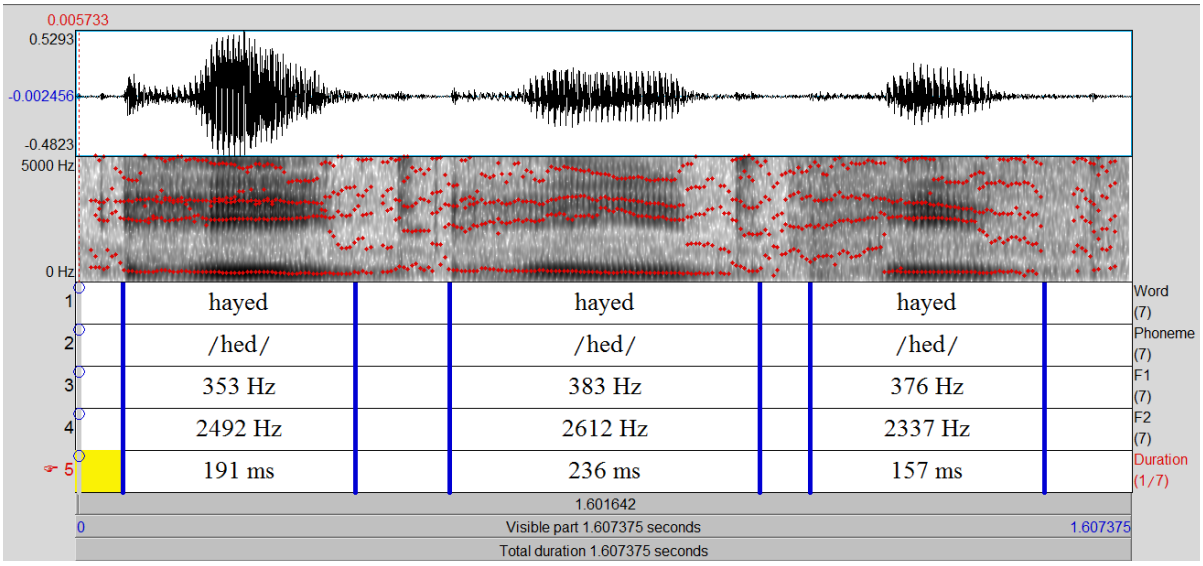

Figure 3: Hayed [e]

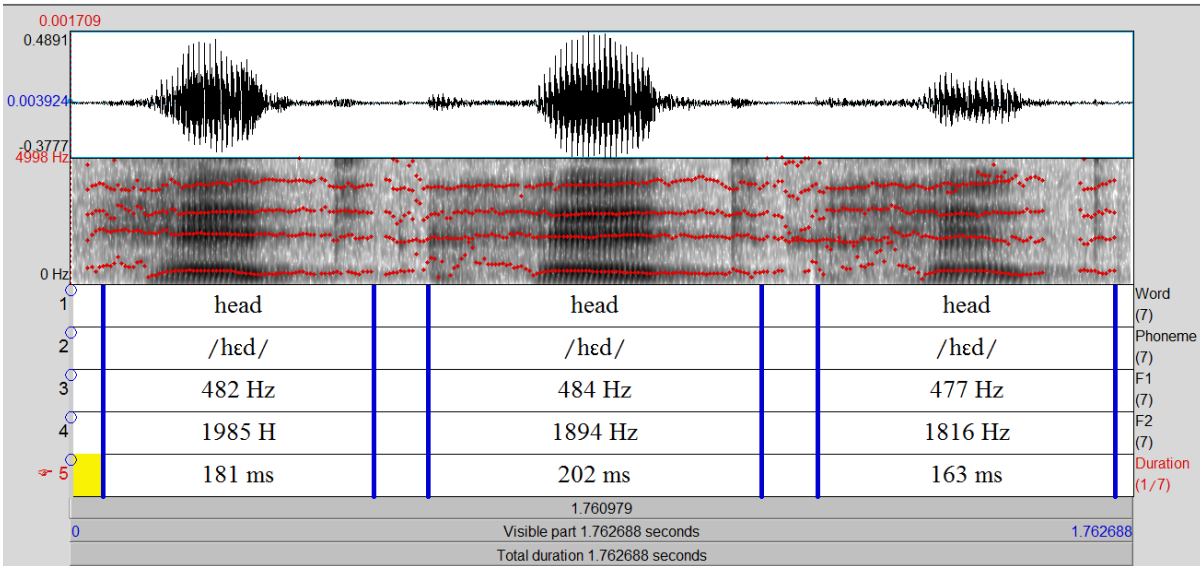

Figure 4: Head [ɛ]

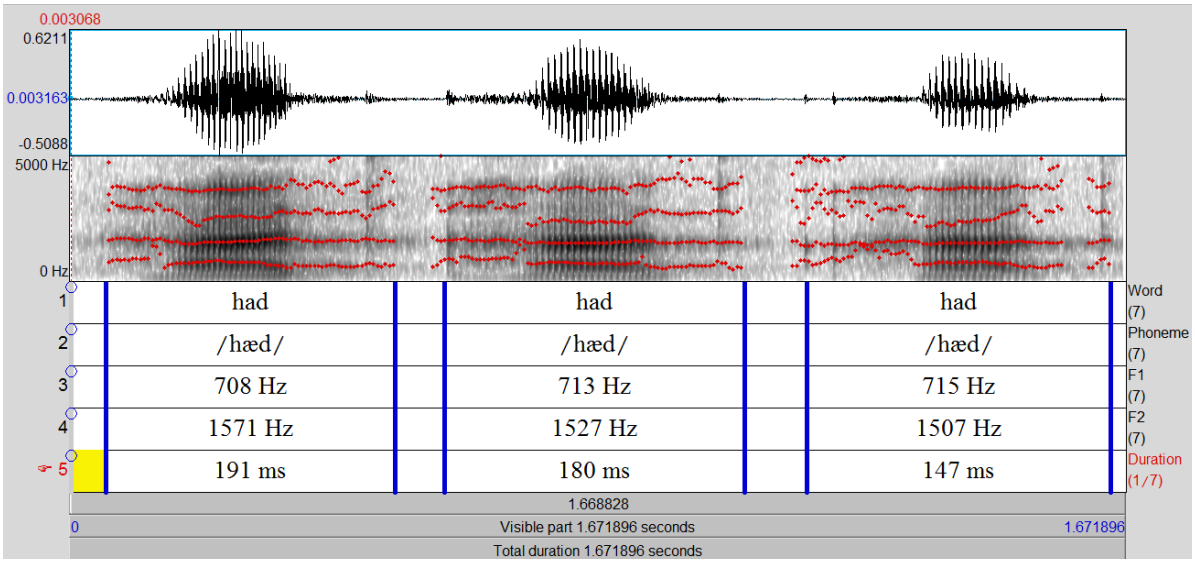

Figure 5: Had [æ]

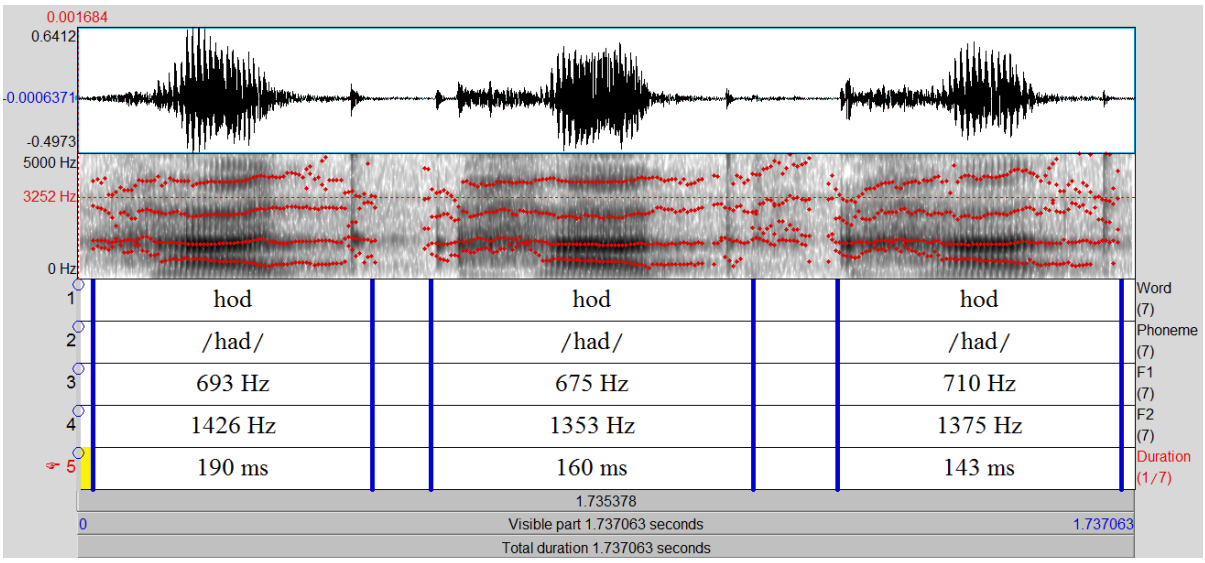

Figure 6: Hod [a]

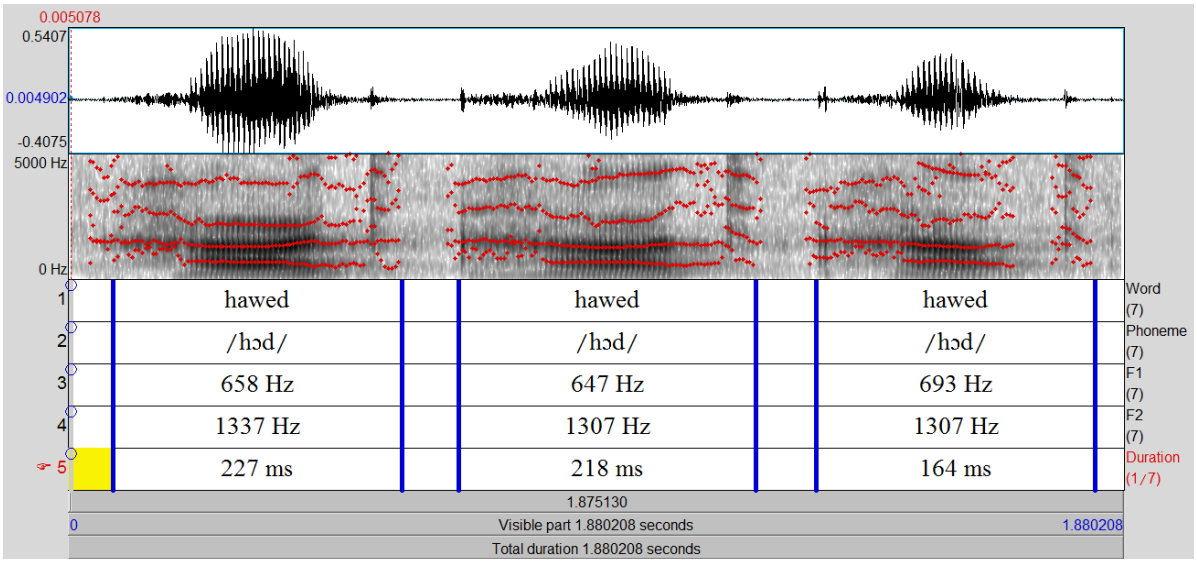

Figure 7: Hawed [ɔ]

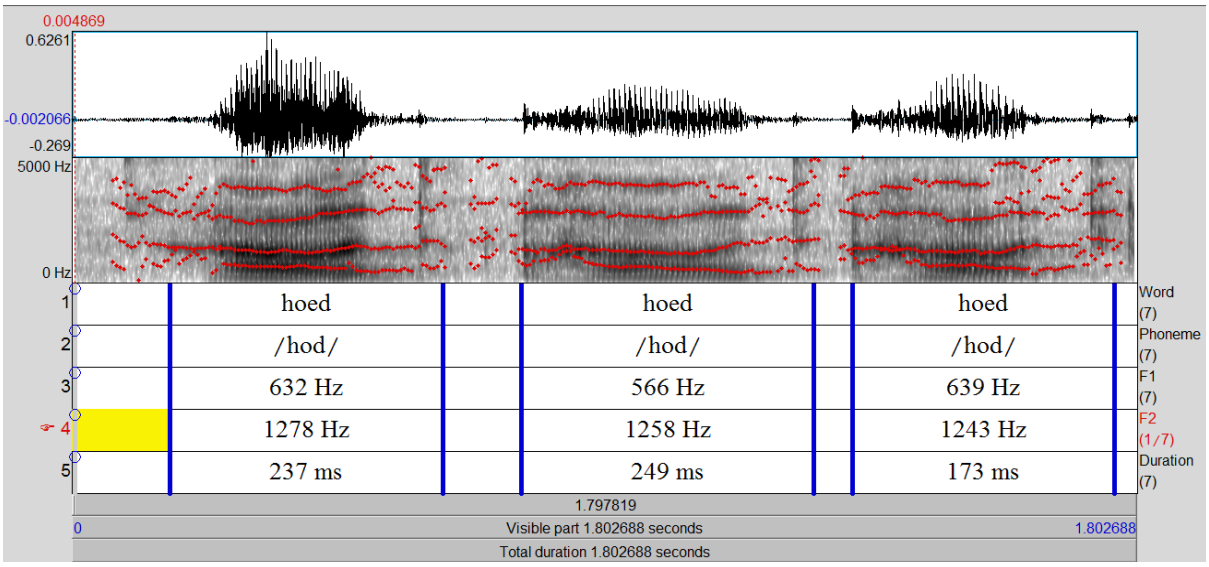

Figure 8: Hoed [o]

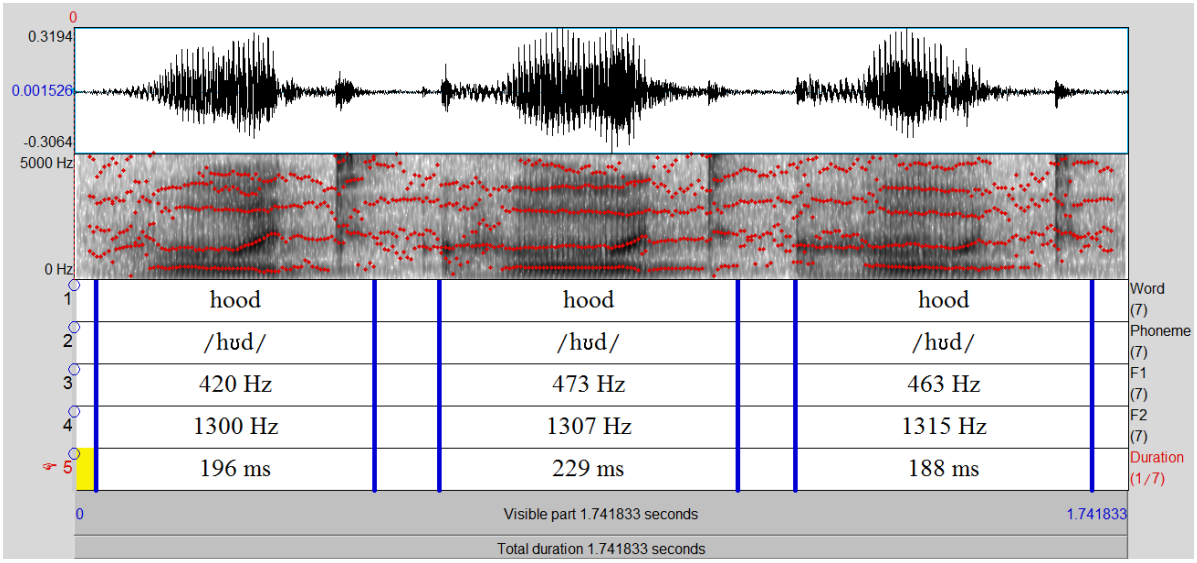

Figure 9: Hood [ʊ]

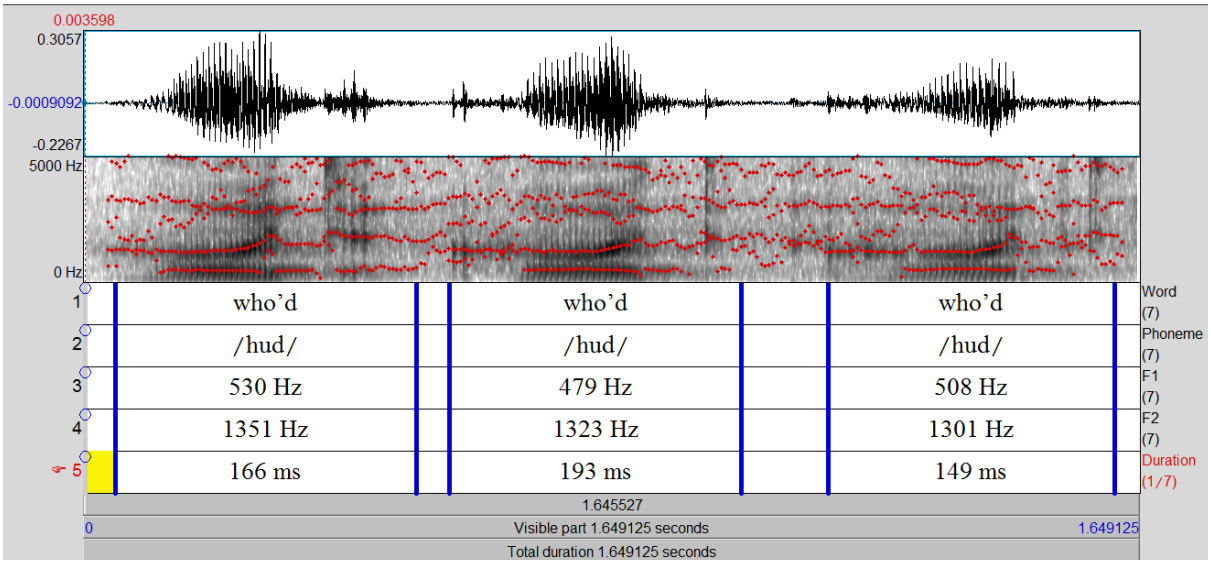

Figure 10: Who'd [u]

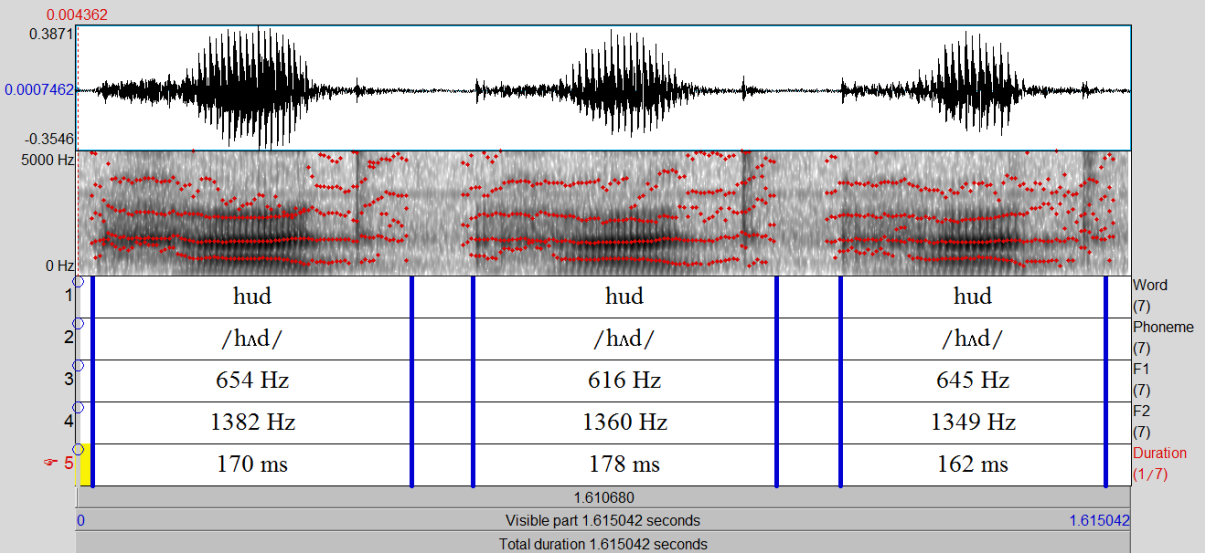

Figure 11: Hud [ʌ]

2.1 Vowel Chart

Words		heed	hid	hayed	head	had	hod	hawed	hoed	hood	who'd	hud	heard
Vowels		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]	[ɝ]
	F0	136	135	NA	130	127	124	129	NA	137	141	130	133
GAE	F1	270	390	NA	530	660	730	570	NA	440	300	640	490
GAE	F2	2290	1990	NA	1840	1720	1090	840	NA	1020	870	1190	1350
SUBJECT	F1	397	470	371	481	712	756	612	693	452	506	638	NA
SUBJECT	F2	2459	2041	2480	1898	1535	1317	1260	1385	1307	1325	1364	NA
DUR		179	157	195	182	173	203	220	164	204	169	170	NA

Table 1: Vowel Data

2.2 Norm Chart

Speaker	Vowel	Context	F1	F2	F3	F1Glide	F2Glide	F3Glide
Nawaf	heed	heed	397.0	2459.0	1.000	397.0	2459.0	1.000
GAE	heed	heed	270.0	2290.0	1.000	270.0	2290.0	1.000
Nawaf	hid	hid	470.0	2041.0	1.000	470.0	2041.0	1.000
GAE	hid	hid	390.0	1990.0	1.000	390.0	1990.0	1.000
Nawaf	hayed	hayed	371.0	2480.0	1.000	371.0	2480.0	1.000
GAE	hayed	hayed	476.0	2089.0	1.000	476.0	2089.0	1.000
Nawaf	head	head	481.0	1898.0	1.000	481.0	1898.0	1.000
GAE	head	head	530.0	1840.0	1.000	530.0	1840.0	1.000
Nawaf	had	had	712.0	1535.0	1.000	712.0	1535.0	1.000
GAE	had	had	660.0	1720.0	1.000	660.0	1720.0	1.000
Nawaf	hawed	hawed	756.0	1317.0	1.000	756.0	1317.0	1.000
GAE	hawed	hawed	570.0	840.0	1.000	570.0	840.0	1.000
Nawaf	hoed	hoed	612.0	1260.0	1.000	612.0	1260.0	1.000
GAE	hoed	hoed	497.0	910.0	1.000	497.0	910.0	1.000
Nawaf	hod	hod	693.0	1385.0	1.000	693.0	1385.0	1.000
GAE	hod	hod	730.0	1090.0	1.000	730.0	1090.0	1.000
Nawaf	hood	hood	452.0	1307.0	1.000	452.0	1307.0	1.000
GAE	hood	hood	440.0	1020.0	1.000	440.0	1020.0	1.000
Nawaf	who'd	who'd	506.0	1325.0	1.000	506.0	1325.0	1.000
GAE	who'd	who'd	300.0	870.0	1.000	300.0	870.0	1.000
Nawaf	hud	hud	638.0	1364.0	1.000	638.0	1364.0	1.000
GAE	hud	hud	640.0	1190.0	1.000	640.0	1190.0	1.000

Table 2: Chart from Normalization

2.3 Vowel Space

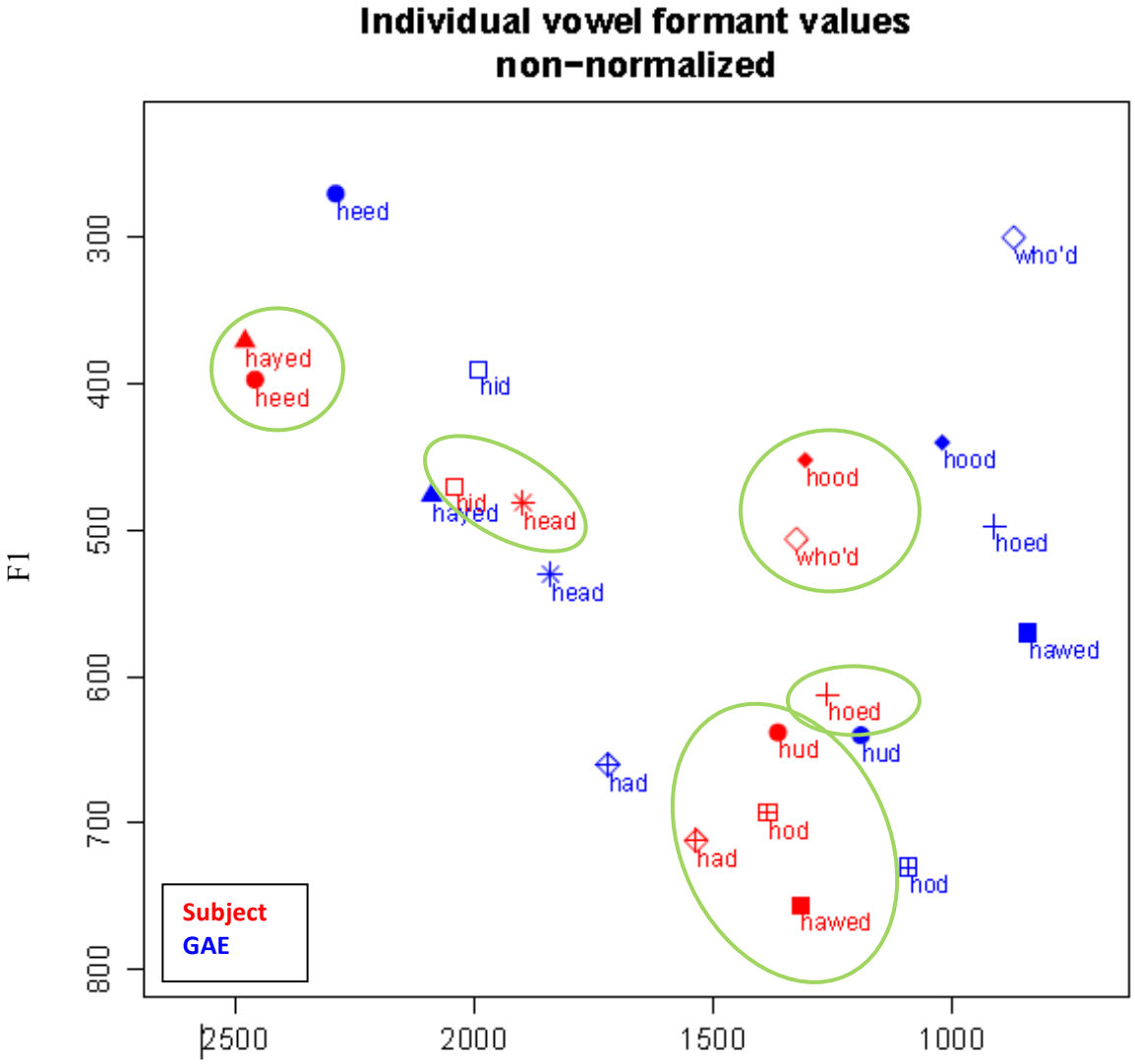

Figure 12: Subject's Vowel Space

2.4 Acoustic Analysis—F1 and F2 Bar Graphs

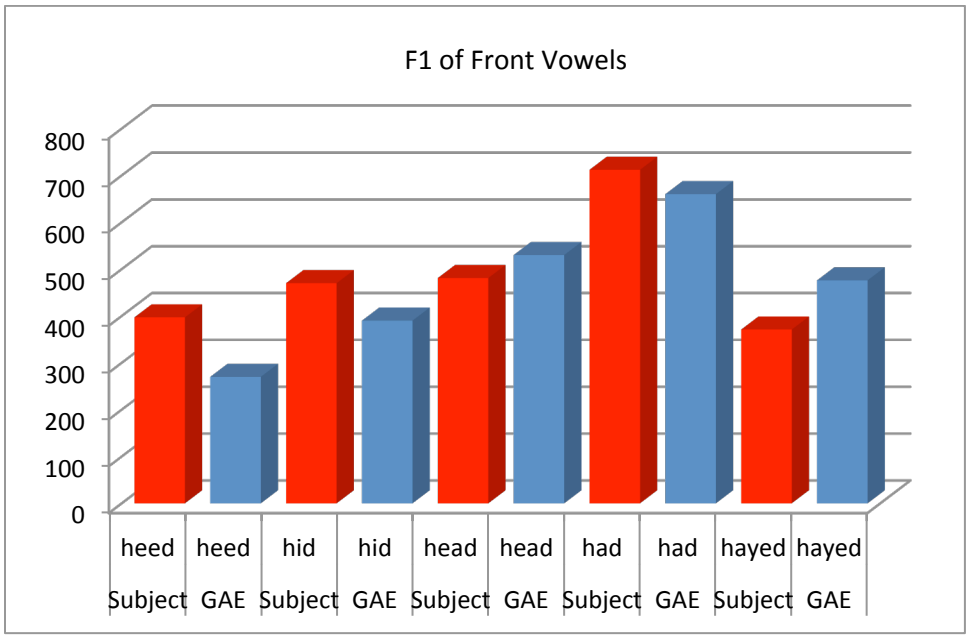

Figure 13: Front F1

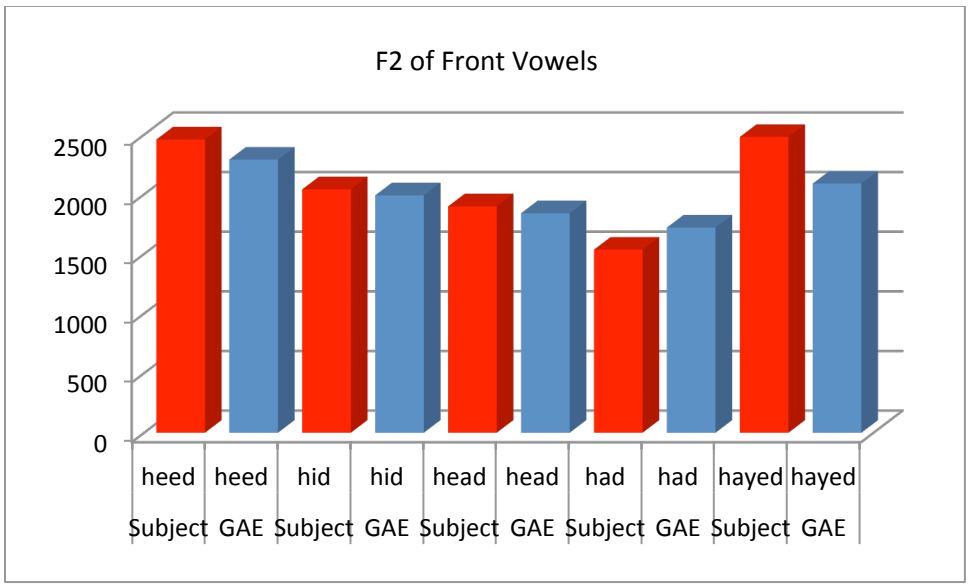

Figure 14: Front F2

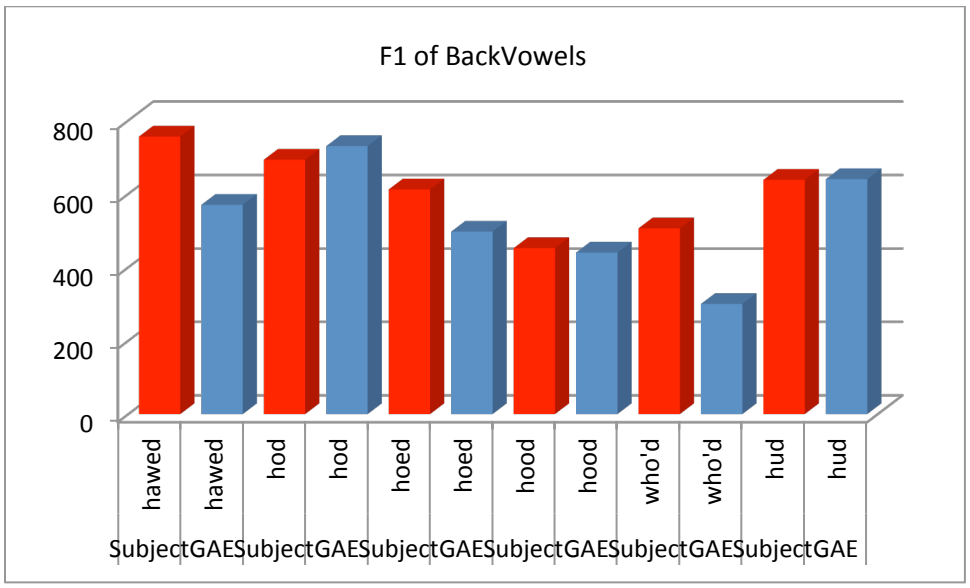

Figure 15: Back F1

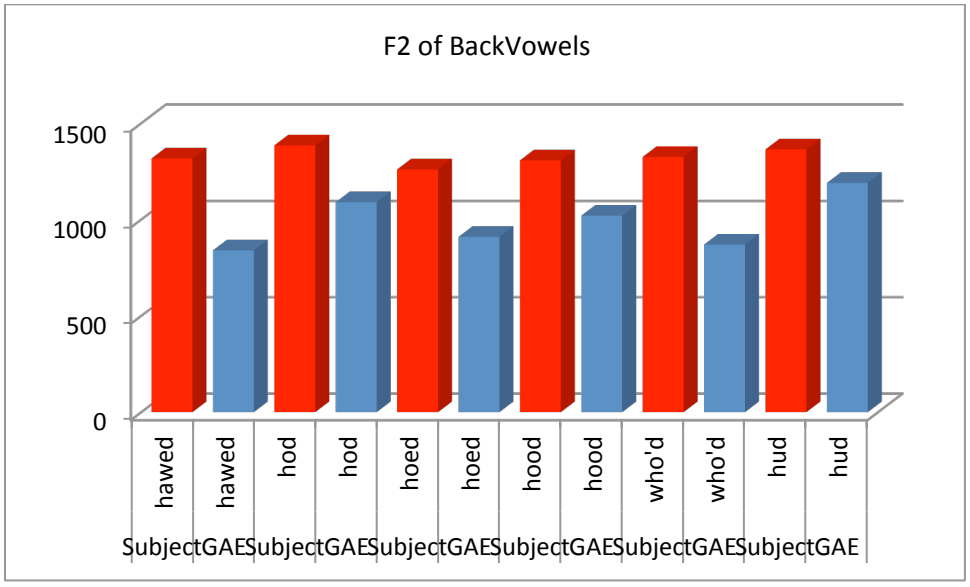

Figure 16: Back F2

3.0 Intelligibility Assessment

Our subject's vowel measurements will be compared to the data of a study done by Peterson and Barney in 1952. In this study, the dialect analyzed was called General American English (GAE). In order to record all of the vowels for this project, an Olympus Digital Voice Recorder (VN-8100PC) was used. All of the words were recorded in the IEC office at St. Cloud State University. The vowels were recorded in an MP3 format and were converted into a .WAV format with the program Audacity. Audacity is a free program which can be downloaded off of the internet. The recordings were then exported and opened with Praat. Praat is also a program that is available publicly online for free and is easily downloadable for anyone's use. The

acoustic measurements of each vowel were done in Praat. After acquiring an F1 and F2 measurement for each vowel, the data was uploaded to the Norm website in order to attain the vowel space shown in Figure 12 (Thomas & Tyler, 2007). Note that in Figure 12, the data in red belongs to our subject and the data in blue is the GAE.

There are several important things to note in regard to the intelligibility issues of our subject's pronunciation. Overall, in comparison to the vowels of the GAE, the subject's high vowels are lowered and the back vowels are more centralized. The subject's vowels also occur in four major clusters, which will cause a great deal of confusion for those who are listening to him. Figures 17-20 show what vowels occur in these clusters.

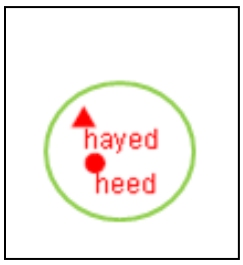

Figure 17

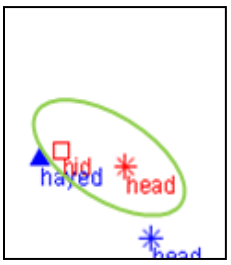

Figure 18

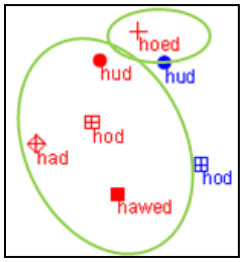

Figure 19

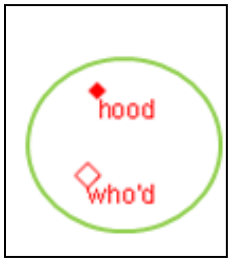

Figure 20

The next issues we will draw your attention to are the intelligibility issues caused by the F1 measurements which occur between the subject's pronunciation and the pronunciation of the GAE. It is important to keep in mind that when considering the F1 measurement, according to Koffi (2011), the median frequency range is 135 Hz. With that being said, one of the largest problem areas is with the subject's [ɛ] and [ɪ] and the GAE's [e]. The F1 of the subject's vowels are only 5 Hz and 6 Hz apart from the GAE's [e] respectively. This means that the listener will have a lot of trouble determining when the subject is using words with the [e] vowel in them because this vowel may sound more like [ɛ] or [ɪ]. For example, "weight" may sound quite comparable to "wet" or "wit" in our subject's pronunciation. Another vowel that causes intelligibility issues for our subject's listeners will be [o]. The subject's [u] is only 19 Hz different from the GAE's [o]. Again, misunderstanding will occur due to the fact that "show" will sound very similar to "shoe". Another location in the subject's vowel space that may cause issues occurs with the subject's vowel [i] and [e]. These two vowels have an F1 that is similar to the GAE's [ɪ]. The subject's F1 in comparison to the GAE's [ɪ] is 7 Hz and 19 Hz respectively. The subject's "wean" and "wane" will be almost analogous with the GAE's "win". The final issue caused by the subject's F1 measurements occurs between the subject's [ɔ] and the GAE's [ɑ]. Here there is only a difference of 26 Hz. Though the measurement is greater than the others, it is still too little of a difference for the human ear to be able to distinguish. Again, this will incur difficulties between words like "caught" and "cot". See Table 3 below for a chart of the measurements.

Subject	F1 Hz	GAE	F1 Hz	Difference
Head [ɛ]	481 Hz	Hayed [e]	476 Hz	5 Hz
Hid [ɪ]	470 Hz	Hayed [e]	476 Hz	6 Hz
Heed [i]	397 Hz	Hid [ɪ]	390 Hz	7 Hz
Who'd [u]	506 Hz	Hoed [o]	497 Hz	9 Hz
Hayed [e]	371 Hz	Hid [ɪ]	390 Hz	19 Hz
Hawed [ɔ]	756 Hz	Hod [a]	730 Hz	26 Hz

Table 3: Comparison of F1: Subject vs. GAE

Though the F2 measurement of a vowel does not affect intelligibility as greatly as the F1 measurement, there are still some differences which are significant enough to be noted. According to Peterson and Barney (1952), the mean frequency range for F2 measurements is 311 Hz. The subject has three vowels that may cause intelligibility issues due to their F2 measurement. The subject's [o] is only 40 Hz more fronted than the GAE's [ʌ], the subject's [ɪ] is only 48 Hz more centralized than the GAE's [e], and the subject's [ɛ] is 191 Hz more centralized than the GAE's [e]. Though this last measurement seems large, it is still not larger than the mean frequency range for F2 measurements and therefore will impede intelligibility. Table 4 holds the F2 measurement for these vowels.

Subject	F2 Hz	GAE	F2 Hz	Difference
Hoed [o]	1260 Hz	Hud [ʌ]	1190 Hz	40 Hz
Hid [ɪ]	2041Hz	Hayed [e]	2089 Hz	48 Hz
Head [ɛ]	1898 Hz	Hayed [e]	2089 Hz	191 Hz

Table 4: Comparison of F2: Subject vs. GAE

Another dynamic we would like to mention are intelligibility issues that occur due to the subject's vowels being similar to each other. Again, we will start with the F1. The subject's [ɪ] and [ɛ] are only 10 Hz apart, causing words such as "pig" and "peg" to be easily confused. Also, his [a] and [æ] are only 19 Hz apart. This means like "hot" and "hat" may be mistaken for one another. Two other vowel combinations occur only 26 Hz apart: [e] and [i] and [o] and [ʌ]. This could cause confusion between words like "raid" and "read" and "pole" and "pull". Two other areas that have a greater difference in F1 but still not enough to pass the mean frequency range are [ɔ] and [æ], [ʊ] and [u], and [ɔ] and [ɑ]. The F1 difference between these sets of vowels is 44 Hz, 54 Hz, and 63 Hz respectively. Again, a person listening to our subject will experience difficulty distinguishing between words in which these vowels occur. See Table 5 below to view the measurements for these vowels.

Subject	F1 Hz	GAE	F1 Hz	Difference
Hid [ɪ]	470 Hz	**Head [ɛ]**	480 Hz	**10 Hz**
Hod [a]	693 Hz	**Had [æ]**	712 Hz	**19 Hz**
Hayed [e]	371 Hz	**Heed [i]**	397 Hz	**26 Hz**
Hoed [o]	612 Hz	**Hud [ʌ]**	638 Hz	**26 Hz**
Hawed [ɔ]	756 Hz	**Had [æ]**	712 Hz	**44 Hz**
Hood [ʊ]	452 Hz	**Who'd [u]**	506 Hz	**54 Hz**
Hud [ʌ]	638 Hz	**Hod [a]**	693 Hz	**55 Hz**
Hawed [ɔ]	756 Hz	**Hod [a]**	693 Hz	**63 Hz**

Table 5: Subject's F1 Vowel Issues

4.0 Pedagogical Implications

The data above provides implications for the subject's future study as well as for teachers of ESL. The implications for the subject's future study will be discussed first. The issues revealed in our subject's vowel space are representative of his social network. He is largely surrounded by speakers of Arabic or low proficiency non-native speakers of English. He receives little input that is higher than his own proficiency level and has not taken significant steps to expand his social network to include the input that is necessary to improve his pronunciation. According to Krashen, a student's optimal input level is language that is slightly higher than that of the learner's own language level (in Gass & Selinker, 2008). If our subject is only surrounded by Arabic L1 speakers or L2 speakers of English whose proficiency level is not high enough to fulfill Krashen's hypothesis, then he is not receiving the kind of input he needs in order to learn the language, specifically pronunciation. His accentedness does actual hinder comprehensibility and intelligibility which in turn will affect his ability to communication efficiently and effectively. Though a native-like accent may not be the goal, our subject still has a lot of work to do in order to attain pronunciation that is only slightly accented while being largely intelligible. So as to improve his pronunciation, the subject needs to take an active role in expanding his social network. Joining clubs, acquiring more friendships with native speakers, and possibly even getting a job are things that would impart more opportunities to use the language and practice pronunciation, as well as provide him with a higher level of input.

Now we will turn our focus to the implications this data offers us for teachers of ESL. Previously in SLA, the focus of pronunciation was on attaining a "native-like" accent (Levis, 2005). Since there are so many Englishes spoken throughout the world, this construct has become muddled. The current trend in SLA is to make a distinction between three main constructs: accentedness, comprehensibility, and intelligibility. There are multiple studies which corroborate this distinction (Derwing and Munro, 1997; Derwing and Munro, 2005; Kang, 2010; Levis, 2005; Nelson, 1982; Saito, 2011). The definition of all three constructs is generally agreed upon and may differ only slightly in word choice. Accentedness is concerning the degree to which the speech of an L2 learner is perceived to differ from that of native speech;

comprehensibility relates to how challenging it is for a listener to comprehend the speech of an L2 learner, and intelligibility analyzes whether or not the message intended by the speaker was actually received by the listener. Munro (2011) explains that even with strong accents, some L2 speakers are entirely intelligible to their listeners. She indicates that the two constructs affecting communication are intelligibility and comprehensibility. Because of this, more attention should be given to these two constructs and less emphasis should be placed on attaining "native-like" speech. With the goal of intelligibility in place, teachers should also find ways to integrate opportunities for authentic communication in the classroom. It is evident with our subject's case that the chances a student has to use Academic English tend to be rare, while when they do occur, they normally occur in the classroom. Incorporating activities, in which students are not only speaking the language but also receiving input at the correct level, will ensure that they are gaining the kind of input and opportunities they need in order to improve their pronunciation and English language skills in general. It is also possible to educate them and introduce, to them, ways in which they can improve their English outside of the classroom, such as those suggested above for our subject. Language learning can be a very individualized task; each learner may have different needs. Much of the focus has turned to teaching the learner to be autonomous by providing them with learning strategies that will help them to do so. Current research calls for the teacher to act more as a coach or facilitator in today's language classroom (Morley, 1991; Murphy, 1991; Sardegna, 2011). In order for students to benefit from this shift in teacher role, teachers must provide them with language strategy training that will enable their students to learn language effectively outside of class (Wong and Nunan, 2011). An example of this is the task-based approach to teaching. This approach focuses on authentic opportunities to communicate with other native speakers outside of the classroom. Frequently teachers are able to connect with local community members to set up authentic experiences in which their students can participate. Such experiences can include going to the local DMV to apply for a driver's license, rent an apartment, discuss ailments with a cooperating doctor at the clinic, or meet with a counselor regarding a college application and potential fields of study. These represent a few ways to approach the construct of pronunciation in and outside of the classroom.

ABOUT THE AUTHORS

Amber Brown is a graduate student in the MA TESL/Applied Linguistics Program at SCSU. She earned a BA degree in Spanish Language from the University of Minnesota, Mankato. She spent a semester abroad in Spain and volunteered teaching ESL to adults. Both of these experiences and her interest in the interface between language and culture led her to pursue a degree in this program. After completing her degree, she plans to teach in the U.S. as well as abroad.

Stacia Oyer is a graduate student in the MA TESOL/Applied linguistics program at SCSU. She earned a BA in Spanish from Minnesota State University in Mankato, MN. She taught in Costa Rica for one year as a certified TEFL instructor. Her decision to further her education was influenced by gratification of teaching EFL students in their native environments. After completing her degree she plans to teach students from school age to adulthood in Minnesota.

Recommendation: This paper was recommended by Professor Ettien Koffi, Ph.D., Linguistics Department, St. Cloud State University, St. Cloud, MN. Email: enkoffi@stcloudstate.edu

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